CONNECTICUT RIVER FLOOD CONTROL PROJECT

SPECIFICATIONS

FOR CONSTRUCTION OF

CHICOPEE DIKE, WILLIMANSETT SECTION

ITEM C.4a (HIRED LABOR)

CHICOPEE, MASSACHUSETTS

FEBRUARY 20, 1941

CORPS OF ENGINEERS, U. S. ARMY

U. S. ENGINEER OFFICE PROVIDENCE, R. I.

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WAR DEPARTMENT
UNITED STATES ENGINEER OFFICE
PROVIDENCE, RHODE ISLAND

APPROPRIATION: EMERGENCY RELIEF, 1938-1940
21X3113 FLOOD CONTROL, GENERAL.

CHICOPEE DIKE, WILLIMANSETT SECTION
ITEM C.4a (HIRED LABOR)
CHICOPEE, MASSACHUSETTS

S P E C I F I C A T I O N S

SECTION I. - GENERAL PROVISIONS

1-01. Location. - The site of the work covered by these specifications is located on the east bank of the Connecticut River, in the north (or Willimansett) portion of the City of Chicopee, Massachusetts.

1-02. Work to be done. - a. The work provided for herein is authorized by the Emergency Relief Appropriation Act of 1938-1940, and by the Flood Control Act of June 28, 1938 (Public No. 761, 75th Congress).

b. The work to be done consists of furnishing all plant, labor and materials and performing all work required for constructing an earth dike complete in accordance with these specifications and the drawings forming a part hereof, together with such incidental work as needed or ordered in writing by the District Engineer. It will consist of the following principal item of construction:

(1) Construction of an earth dike between dike stations D10+22 and D11+89.

1-03. Organization. - The work described in these specifications will be executed by the Area Engineer whose responsibility shall correspond to that of "contractor" as defined in Article 1, standard construction contract form No. 23. The District Engineer as the officer responsible for the final accomplishment of the work specified will correspond to the "contracting officer."

1-04. Responsibility of the District Engineer. - a. The District Engineer will decide all questions which may arise as to performance, quantity and quality, acceptability, fitness and materials to be furnished and used, and the rate of progress of the work as described by these specifications and will decide all questions which may arise as to interpretations of the specifications and drawings.

b. Changes which are necessary due to changed conditions in the field and necessitate a change in the specifications or drawings

will be made in writing by the District Engineer provided that any change involving an estimated increase or decrease of more than $500 will be subject to the final approval of the Chief of Engineers, U. S. Army.

c. The work will be conducted under the general direction of the District Engineer and will be inspected by inspectors appointed by him. The organization of the inspection staff will be entirely separate from the Area Engineer's organization and will be directly responsible to the District Engineer. It is understood that any instructions given by the District Engineer through an inspector or other authorized employee are to be considered instructions or decisions of the District Engineer in all cases.

1-05. Description of project. - The dike will be of the rolled-fill type, about 167 feet long with a maximum height of about 10 feet. The dike will be of random material with a core of selected impervious material. The slopes and crest of the dike will be sodded and seeded as indicated on the drawings. Vitrified clay pipe drains will be installed to provide proper drainage for the landside toe of the dike.

1-06. Drawings. - a. The work shall conform to drawings marked, "Chicopee Dike, Willimansett Section, Hired Labor, Item C4a, Chicopee, Massachusetts," as listed below, which drawings form a part of these specifications and are filed in the United States Engineer Office, Providence, Rhode Island.

LIST OF DRAWINGS

Sheet No.	Title	File No.
1	Project Location and Index	CT-4-2838
2	General Plan and Details	CT-4-2839
3	Subsurface Explorations	CT-2-1322

b. The work shall also conform to such other drawings relating thereto used in explanation of details or minor modifications as may be furnished by the District Engineer from time to time during construction.

1-07. Quantities. - The following estimate of quantities is given to serve as an indication of the extent of the work covered by these specifications:

Item	Designation	Unit	Quantity
1	Preparation of Site	acre	0.3
2	Stripping	cu. yd.	600
3	Common Excavation - General	" "	50
4	Common Excavation - Impervious Borrow	" "	250
5	Common Excavation - Random Borrow	" "	2,900
6	Impervious Fill	" "	250

Item	Designation	Unit	Quantity
7	Random Fill	cu. yd.	2,900
8	Gravel Bedding	" "	10
9	Semi-Compacted Backfill	" "	40
10	8-Inch V.C. Pipe (open joints)	lin.ft.	121
11	8-Inch V.C. Pipe (mortar joints)	" "	52
12	Concrete	cu. yd.	1.5
13	Miscellaneous Iron and Steel	lb.	600
14	Topsoil	cu. yd.	400
15	Sodding and Seeding	acre	0.25
16	Manhole Brickwork	M. Brick	2.00

1-08. Physical data. - a. General. - Materials for constructing the earth dike are available in the vicinity of the work. Locations of borrow area are shown on the drawings. Borings have been made in the vicinity of the proposed work with reasonable care and laboratory analyses have been made of the samples from some of these holes. Samples of materials taken from them, and records of laboratory analyses and results of other studies, may be seen at the United States Engineer Office, Providence, Rhode Island.

b. Transportation facilities. - (1) Railroads. - The Boston and Maine Railroad serves the City of Chicopee with main line traffic. The Area Engineer shall investigate the availability of the sidings from the railroad company and make all arrangements with the latter for the use of any sidings for the delivery of any materials and equipment to be used on the work.

(2) Highways. - First-class highways also serve the city. The Area Engineer shall provide for his own construction or access roads and their maintenance. He shall make his own investigation of available roads for transportation, of load limits for bridges and roads, and other road conditions affecting the transportation of materials and equipment to the site of the work.

c. Weather conditions. - The locality is subject to atmospheric temperatures ranging from minus 20 degrees to plus 104 degrees Fahrenheit. The mean annual precipitation at Chicopee is 44.79 inches. The mean monthly precipitation varies from a low of 3.32 inches in November to a high of 4.28 inches in August.

1-09. Lands, rights of way, damages. - The District Engineer will designate the lands, rights of way and easements which will be required for the project, and the Area Engineer shall undertake the construction only when directed by the District Engineer.

1-10. Removal of rubbish. - The Area Engineer shall keep the site free from rubbish. Suitable spoil areas for receiving refuse from the grounds shall be provided, and the rubbish shall be removed and disposed of as directed by the District Engineer and in a manner agreeable to the

local interests and in accordance with the sanitary provisions of Paragraph 1-18. At the conclusion of the work, the site shall be cleaned up and all rubbish and unused materials shall be disposed of in accordance with Paragraph 8-03.

1-11. Datum and bench marks. - The plane of reference of mean sea level as used in these specifications is that determined by the following bench mark:

T.B.M. #4 (U.S.C. & G.S.)

At Chicopee, Hampden County, about 100 yards south of the railroad station, at the southeast corner of the base of Semaphore #32. The top of an iron bolt. Elevation 81.332 feet M.S.L.

1-12. Lines, grades, stakes and templates. - The Government inspector will define and approve on request all points and elevations reasonably necessary for the prosecution of the work from lines and grades established by the survey party.

1-13. Planimeter. - For the estimating of quantities in which computation of area by arithmetic and geometric methods will be comparatively laborious, the planimeter shall be considered an instrument of precision adapted to the measurement of such areas unless otherwise directed by the District Engineer. Measurement of quantities in place after compaction will be used for cost keeping data.

1-14. Responsibility for work. - The Area Engineer shall be responsible for the work and take all precautions for preventing injury to persons and property in or about the work.

1-15. Borrow areas. - Borrow areas will be furnished by the local interests without cost to the Government, including rights of way for transportation purposes across property not owned. If sufficient material is not available in the borrow areas indicated on the drawings or otherwise provided to complete the work, additional areas will be furnished without cost to the Government.

1-16. Soil classification. - a. Soil classifications as referred to in these specifications conform to descriptive terms and limits of classifications as shown on Table No. 1, "Soil Classification," and Plate No. 1, "Diagram Showing Limits of Soil Classes," both of which form a part of these specifications.

b. Table No. 1 - Soil Classification.
(See Page 5 for Table No. 1)

c. Plate No. 1 - Diagram Showing Limits of Soil Classes.
(See Page 6 for Plate No. 1)

PROVIDENCE SOIL CLASSIFICATION
U. S. ENGINEER OFFICE
PROVIDENCE, R. I.

TABLE NO. 1

CLASS	DESCRIPTION OF MATERIAL
1	Graded from Gravel to Coarse Sand. - Contains little medium sand.
2	Coarse to Medium Sand. - Contains little gravel and fine sand.
3	Graded from Gravel to Medium Sand. - Contains little fine sand.
4	Medium to Fine Sand. - Contains little coarse sand and coarse silt.
5	Graded from Gravel to Fine Sand. - Contains little coarse silt.
6	Fine Sand to Coarse Silt. - Contains little medium sand and medium silt.
7	Graded from Gravel to Coarse Silt. - Contains little medium silt.
8	Coarse to Medium Silt. - Contains little fine sand and fine silt.
9	Graded from Gravel to Medium Silt. - Contains little fine silt.
10	Medium to Fine Silt. - Contains little coarse silt and coarse clay. Possesses behavior characteristics of silt.
10 C	Medium Silt to Coarse Clay. - Contains little coarse silt and medium clay. Possesses behavior characteristics of clay.
11	Graded from Gravel or Coarse Sand to Fine Silt. - Contains little coarse clay.
12	Fine Silt to Clay. - Contains little medium silt and fine clay (colloids). Possesses behavior characteristics of silt.
12 C	Clay. - Contains little silt. Possesses behavior characteristics of clay.
13	Graded from Coarse Sand to Clay. - Contains little fine clay (colloids). Possesses behavior characteristics of silt.
13 C	Clay. - Graded from sand to fine clay (colloids). Possesses behavior characteristics of clay.

PROVIDENCE DISTRICT SOIL CLASSIFICATION

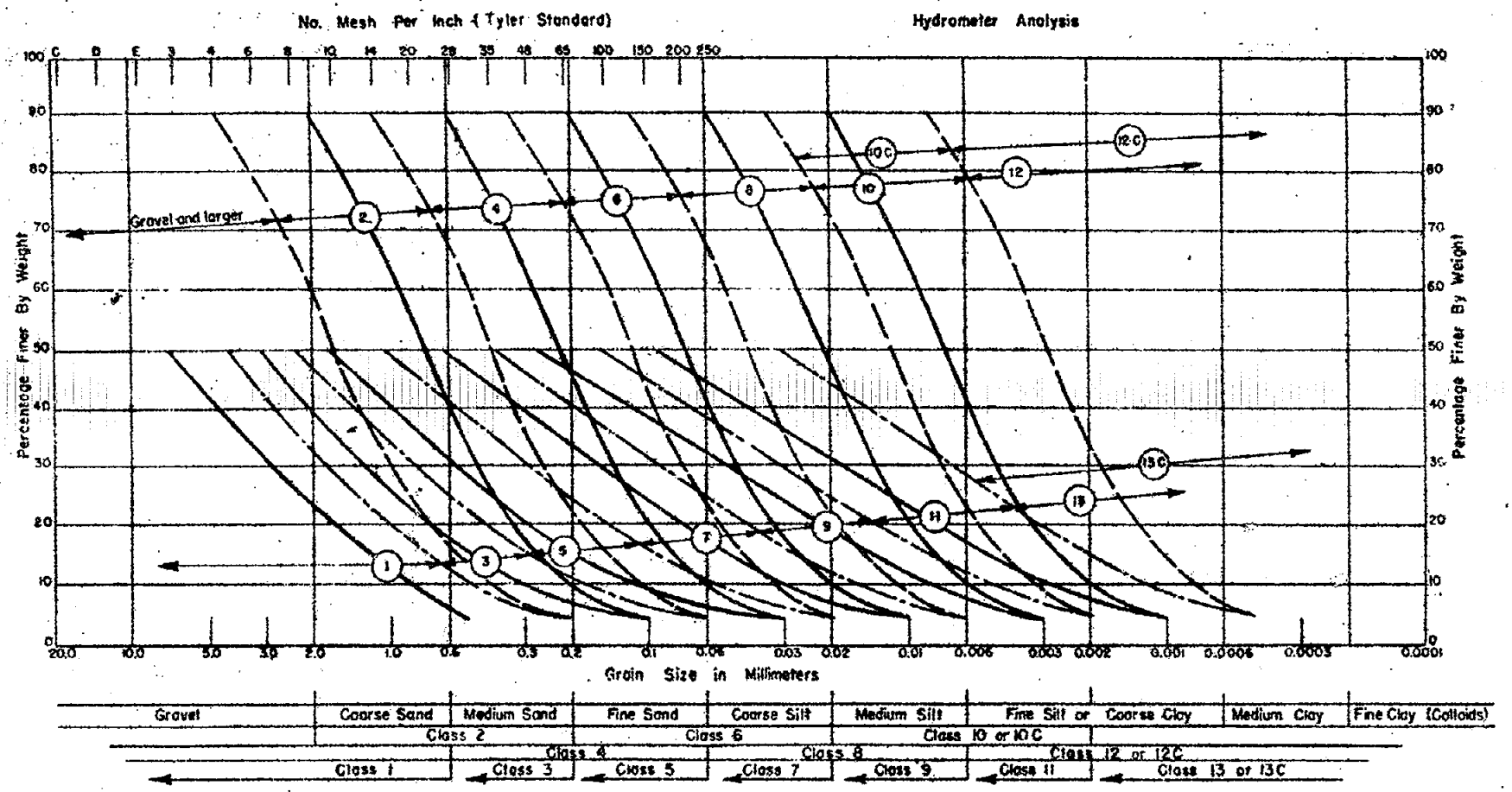

DIAGRAM SHOWING LIMITS OF SOIL CLASSES

PLATE No. 1

1-17. Material purchased by the District Engineer. - All orders, shipping bills or memoranda accompanying material purchased by the District Engineer shall clearly indicate weights and shall be so worded or marked that each item, piece or member can be definitely identified on the drawings.

1-18. Liability and safety requirements. - a. The Area Engineer shall be responsible that his employees strictly observe the laws of the United States affecting all operations at the site under the project. He shall comply with all applicable Federal and State laws under which he is operating, including those concerning the inspection of boilers, hulls, and other equipment, and the licensing of engineers, masters and other employees.

b. The Area Engineer shall conduct the work with due regard to adequate safety and sanitary requirements and shall maintain his plant and equipment in safe condition. He shall conform to current safety engineering practices as set forth in the Manual of Accident Prevention in Construction, published by the Associated General Contractors of America; the publications of the National Safety Council, and with all applicable State or local safety and sanitary laws, regulations and ordinances.

c. The District Engineer will require such safety and sanitary measures to be taken as the nature of the work and the conditions under which it is to be performed demand. Such measures shall include:

(1) The provision of adequate extinguishers or fire-fighting apparatus in and about all buildings and plant erected or used at the site of the work;

(2) Adequate first aid and life saving equipment;

(3) Adequate illumination during night operations;

(4) Watchman service at any railroad crossings used by employees for access to the site;

(5) Warning lights between sunset and sunrise and during fogs, on all cofferdams, vessels, range piles and other obstructions placed in navigable waters during the progress of the work;

(6) Danger lights and barricades, in accordance with the laws of the State of Massachusetts, on all intercepted highways and on such obstructions and hazards which encroach on, or are adjacent to, public rights of way;

(7) Instructions in accident prevention to reach all employees;

(8) Such machinery guards, safe walkways, scaffolds, ladders, bridges, gang planks and other safety devices, equipment and apparel as are necessary to prevent accidents or injuries.

d. The Area Engineer shall report promptly to the District Engineer in form prescribed by him all accidents occurring at the site of the work.

1-19. Use of explosives. - All blasting shall be done in the most careful manner so as not to endanger life, property, or the work. Explosives used shall be of a quality and power approved by the District Engineer. Dynamite in a frozen condition shall not be used. Approved explosives shall be stored before use in a suitable magazine, in an approved location, in compliance with State and local laws and regulations. Detonators shall be kept in a separate magazine not less than 100 feet from the explosives magazine. Magazines shall be plainly marked with large letters "DANGER-EXPLOSIVES" and shall be kept locked. Accurate daily records shall be kept to account for each piece of explosive and detonator from the time of delivery at the magazine until its discharge in use.

1-20. Order of work. - The work covered by these specifications shall be commenced on the date designated by the District Engineer and shall be completed on or before June 30, 1941. The work shall be carried on at such localities and in such order of precedence as may be found necessary by the District Engineer. The location and limits of the work to be done will be plainly indicated by the District Engineer or his agents by stakes or otherwise. The District Engineer may suspend the work wholly or in part for such periods as he may deem necessary on account of conditions considered unfavorable for the suitable prosecution of the work.

1-21. Plant organization. - a. The Area Engineer shall provide sufficient plant of size suitable to meet the requirements of the work and shall maintain the plant and equipment in such condition as to perform the work efficiently and economically within the time specified. An ample force shall be maintained to conduct the work properly and efficiently.

b. No reduction in the capacity of the plant employed on the work shall be made except when approved by the District Engineer. The measure of the "capacity of the plant" shall be its actual performance on the work to which these specifications apply.

1-22. Employment of labor. - The method of employment, rate of wages, and monthly hours of employment for the various classifications or workmen shall be in strict conformity with the schedule (or any authorized revision thereof) furnished by the Work Projects Administration for Chicopee. The District Engineer will report to the Department of Labor within five days after the close of each calendar month, on forms to be furnished by the Department of Labor, the number of persons employed on the project, the man-hours worked and the total expenditure for materials. No work shall be done on Sundays or on days declared by Congress as holidays for per diem employees of the United States except in cases of emergency, and then only with the written consent of the District Engineer. Night work, when necessary to maintain operating schedules, will be permitted upon written approval of the District Engineer. (See Paragraph 1-20).

1-23. Purchase of supplies and materials. - a. Because the materials listed below, or the materials from which they are manufactured, are not mined, produced, or manufactured, as the case may be, in the United States in sufficient and reasonably available commercial quantities and of a satisfactory quality, their use in the work herein specified (subject to the requirements of the specifications) is authorized without regard to the country of origin:

Platinum	Nickel	Asbestos
Chromium	Rubber	China wood oil (tung oil)
Cork	Teakwood	Balsa wood
Jute	Silk	English ball clay
Kauri gum	Sisal	English china clay
Lac	Tin	Natural copper-nickel alloy

b. Articles, materials, or supplies manufactured in the United States and containing mercury, antimony, tungsten, or mica of foreign origin may be used (subject to the requirements of the specifications) in the work herein specified because such manufactured articles, materials, or supplies have been manufactured in the United States substantially all from articles, materials, or supplies mined, produced, or manufactured, as the case may be, in the United States.

1-24. Quality and inspection of supplies and materials. - a. All materials, supplies and articles used shall be, in so far as is practicable, the standard stock products of recognized and reputable manufacturers and shall be sufficient in strength, durability, usefulness and convenience for the purpose intended. All materials, parts and equipment shall be of the highest grade, free from defects and imperfections, of recent manufacture and unused. Workmanship shall be of the highest grade and in accordance with the best modern practice.

b. All materials, supplies, and parts and assemblies thereof, purchased for the work covered by these specifications, shall be inspected in conformity with modern approved methods as directed by the District Engineer. Unless waived in writing by the District Engineer, all tests and trials shall be made in the presence of a duly authorized representative of the District Engineer. When the presence of the inspector is so waived, sworn statements, in duplicate, of the tests made and results thereof shall be furnished the District Engineer by the supplier. All costs of all tests and trials excepting the expenses of the Government inspector shall be borne by the supplier.

1-25. Cost accounting. - a. The Area Engineer shall keep an accurate cost distribution record of all work done and shall submit a monthly cost report to the District Engineer. The cost shall be kept so that proper charges may be made against the items in Paragraph 1-07.

b. A separate account shall be kept of all labor charges in order that employees' compensation insurance may be determined.

c. The cost and expense of inspection and surveys shall be kept separately and not included in the actual cost of performing the work.

d. Prior to the commencement of the work, the Area Engineer shall prepare a Job Estimate Summary Sheet (Form No. 18 Costs) in quadruplicate and forward same to the District Engineer, attaching thereto the engineering estimate for performing the work. The final cost shall reflect all charges contemplated in the estimate.

e. Nothing in this paragraph shall be construed as changing the method by which costs are now reported in monthly and annual reports required by the cost keeping manual.

1-26. Protection of existing structures. - During construction operations, on work covered by these specifications, the Area Engineer shall protect all existing structures and accepted work. Any disturbances or damage to any structures by operations under these specifications shall be repaired promptly by the Area Engineer without credit to the work.

1-27. Final examination and acceptance. - As soon as practicable after the completion of any part of the work which in the opinion of the District Engineer will not be subject to injury by further operations under these specifications, such work may be examined as deemed advisable by the District Engineer. The District Engineer will make a thorough examination of same and if it is found to comply fully with the requirements of the specifications, it will be accepted.

SECTION II. PREPARATION OF SITE (Item 1).

2-01. Work included. - Clearing, grubbing, and disposal of materials shall be done as directed by the District Engineer, within the limits shown on the drawings or established in the field.

2-02. Clearing. - a. Clearing shall include all necessary portions of the following areas: (1) The area within the limits of the foundation of the required earth dike, together with a 5-foot strip measured horizontally beyond and contiguous to the toe line on each side of the dike, (2) borrow areas, and (3) portions of the river bank or any other area designated by the District Engineer within the limits shown on the drawings.

b. Trees and other obstructions shall be removed by the Area Engineer from the sites of the proposed structures and borrow areas when and as directed by the District Engineer and may be removed from other areas only to the extent directed or permitted. The Area Engineer shall preserve and protect from injury all trees not required to be removed.

c. All timber, undergrowth, brush, logs, weeds, and debris of any nature shall be cleared and removed from the site of the work as directed by the District Engineer.

2-03. Grubbing. - a. The areas to be grubbed shall include the foundation area for the dike and other areas as may be directed by the District Engineer.

b. All such areas shall be thoroughly grubbed of all stumps, roots, buried logs, and other objectionable matter. Tap roots and other projections over 1-1/2 inches in diameter within the limits of the dike shall be grubbed out to a depth at least 3 feet below the ground surface, unless otherwise directed by the District Engineer.

2-04. Removal of structures. - The removal of existing structures and utilities required to permit the orderly prosecution of the work covered by these specifications will be accomplished by local agencies unless otherwise shown on the drawings. Whenever a telephone or telegraph pole, pipe line, conduit, fence, sewer or other utility is encountered and must be removed to permit completion of the work, the District Engineer will notify the proper local authorities, and the designated utility will be removed promptly.

2-05. Disposal of materials. - All materials removed, as specified above, shall be disposed of by burning or by removal to approved disposal areas as directed. No material shall be thrown into or left along the bank of the river. The disposal of material shall closely follow the operations of clearing and grubbing so that brush and other debris will not be washed into the river in case of high water. At no time shall material be placed on land adjacent to the construction area. No damage of any nature shall be inflicted upon adjoining property owners by unwarranted entry or disposal of material on adjacent property.

2-06. Measurement and credit. - The quantity to be credited under Item 1 will be the number of acres cleared. Credit for all work in connection with the preparation of the site as above specified, including the loading, hauling, and disposal of the materials, will be made under Item 1, "Preparation of Site".

SECTION III. EXCAVATION (Items 2 to 5 incl.)

3-01. General provisions. - a. Scope of work. - The location and character of the proposed structures and the location and logs of borings are shown on the drawings (see Paragraph 1-06). It is the intent of the Government that excavation be made to the lines and grades given thereon but the right is reserved to modify any part of the work, if, in the opinion of the District Engineer, conditions require such modification.

b. Disposal of material. - (1) Material from the excavations, except stripping, shall be used, if possible, in the permanent construction as directed by the District Engineer. No material, except stripping, shall be wasted unless specifically authorized by the District Engineer. If, at the time of excavation, it is not possible to place the material in the proper section of the permanent construction, it shall be stockpiled in approved areas for later use. Materials from the excavation that are unacceptable for use in the permanent construction shall be wasted in spoil areas in approved locations as directed by the District Engineer. Upon completion of the work, spoil areas shall be graded and dressed neatly to the satisfaction of the District Engineer.

(2) Topsoil and sod obtained from the stripping operation shall be stockpiled in approved locations to be used later in the locations shown on the drawings, unless otherwise authorized by the District Engineer.

c. Measurement. - (1) Excavation will be measured in place and the volume thereof will be computed between the original ground surface as determined by a survey made just prior to the commencement of the work and the excavation lines shown on the drawings.

(2) Where excavation lines are not shown on the drawings, measurement will be made of the volume between the original surface as determined from the survey made just prior to the commencement of the work and the lines and grades established by the District Engineer.

d. Credit. - (1) Items included. - Credit for the various classes of excavation shall include the cost of all labor, plant and incidentals, for excavating, loading, hauling and disposal of the material in the embankment or spoil areas, including any stockpiling and rehandling, and the grading and dressing of spoil areas.

(2) Construction roads. - The construction and maintenance of roads and bridges for the Area Engineer's use will not be credited under a separate item but shall be included in the credits for the other items of work.

(3) Excavation lines. - Credit for all structure excavations will be made to the excavation or slope lines shown on the drawings

regardless of whether or not it is necessary to remove the material to slopes greater or less than those shown. No credit will be made for excavation outside of the limits described above, and the Area Engineer will be required to backfill any such excess excavation with approved material, or with additional concrete where excess excavations are adjacent to concrete structures, without additional credit.

(4) Shoring. - Where approved by the District Engineer, shoring may be used in lieu of excavation to the slope or excavation lines shown on the drawings. The Area Engineer shall be responsible for the unfinished work, and that workmen shall be safe from danger of caving or slides while making structure excavations. Shoring shall be erected in a safe and workmanlike manner, and shall be placed in such a way as to afford ready inspection of and ample clearance for the permanent work. Shoring shall be removed upon completion of the permanent work or as soon as the construction does not require its use. No credit will be made for temporary shoring, but the cost thereof shall be included in the credit for the excavation.

(5) Temporary drains. - The Area Engineer shall maintain the site of the work and adjacent grounds in a well drained condition. Temporary drains and ditches required shall be constructed by the Area Engineer without additional credit.

(6) Additional credit. - Additional credit will be made to replace portions of the river bank and dike washed out by flooding or scouring, or that required to be removed on account of slides, or for the removal and disposal of all objectionable materials, provided such replacement of material was not caused by negligence of the Area Engineer. Quantities for additional credit will be measured as directed by the District Engineer, and credit will be made under the applicable items.

3-02. Classification. - All materials excavated will be classified as follows:

a. Common excavation shall include the removal of all materials, except stripping, to the lines and grades shown on the drawings or established by the District Engineer.

b. Detailed classification is as follows:

(1) Stripping (Item 2). (see Paragraph 3-03).

(2) Common Excavation (see Paragraphs 3-04 and 3-05).

General (Item 3).

Borrow Area (Items 4 and 5).

3-03. Stripping (Item 2). - a. Work included. - The Area Engineer shall strip the area to be covered by the earth dike to a sufficient depth

to remove all material not suitable for the foundation of the dike as directed by the District Engineer. The unsuitable materials to be removed shall include sod, topsoil, rubbish below the ground surface not removed by clearing and grubbing, all loose, weathered, or otherwise unsatisfactory rock and any other objectionable material. The maximum depth of excavation classified as "stripping" shall be 3 feet. Any additional excavation required to remove unsuitable material shall be classified as "common excavation - general", unless otherwise directed by the District Engineer.

b. Disposal of materials. - The provisions of Paragraph 3-01b shall apply.

c. Measurement and credit. - Measurement will be made in accordance with Paragraph 3-01 c. Credit for all work in connection with stripping, including the loading, hauling, disposal of the materials, and all stockpiling and rehandling required, will be made under Item 2, "Stripping" (see Paragraph 3-01 d).

3-04. Common excavation - general (Item 3). - a. Work included. - The Area Engineer shall excavate and dispose of the materials classified as common excavation - general above and below the mean water level in the river to the lines and grades shown on the drawings for the respective areas, or as otherwise directed by the District Engineer. Excavation shall be performed in accordance with a schedule of operations to be approved by the District Engineer. Common excavation - general includes excavation for the foundation of the earth dike, additional to that included under Items 1 and 2, and any other required common excavation for structures, drains and ditches not included in other items of the work.

b. Shoring. - See Paragraph 3-01 d(4).

c. Sheeting and pumping. - The Area Engineer shall provide all necessary pumps to unwater the site properly and to keep the site free from water during such time as the work is under construction, and shall provide all necessary bulkheads and drains.

d. Disposal of materials. - The provisions of Paragraph 3-01 b shall apply. Excavated materials not used in permanent construction may be used in temporary construction if approved by the District Engineer.

e. Measurement and credit. - See Paragraph 3-05 c.

3-05. Common excavation - borrow areas (Items 4 and 5). - a. Work included. - The Area Engineer shall excavate in the indicated borrow areas or other approved areas, the impervious and random materials to be used in the dike or miscellaneous fills. Excavation shall include the transportation of the material to the point of disposal. Borrow areas shall be stripped to the limits established by the District Engineer. To provide suitable fill materials, excavations shall be made to the depths

and in the locations as directed by the District Engineer. During and after excavation the borrow areas shall be graded so that all surface water will drain readily from them. The borrow areas shall be dressed smoothly and evenly, left in a neat condition satisfactory to the District Engineer, and shall be graded so that the slopes blend into the surrounding topography.

b. Disposal of materials. - The provisions of Paragraph 3-04 d shall apply.

c. Measurement and credit. - Measurement for excavation work under Items 3 to 5, inclusive, will be made as specified in Paragraph 3-01 c. Credit for all work in connection with excavation under Items 3 to 5, inclusive, including the loading, hauling and disposal of the materials, as specified in Paragraph 3-01 d, will be made at the applicable credit for Items 3 to 5, inclusive. Stripping of borrow areas will be credited to the work under Items 4 or 5 as applicable.

SECTION IV. EARTH DIKE (Items 6 and 7)

4-01. Definitions. - The term "embankment" as used in these specifications includes earth fill of two types for the earth dike, and all other specified or directed earth fills within the limits of the dike necessary to complete the embankment shown on the drawings. The two types of earth fill are "selected impervious" under Item 6, for the dike core, and the "random" under Item 7, forming the remainder of the embankment.

4-02. Work included. - The Area Engineer shall grade and consolidate materials required for the embankment, to the elevations, lines, grades and cross sections shown on the drawings, with such increased height and width as may be deemed necessary by the District Engineer to allow for later shrinkage or settlement. The Area Engineer shall use suitable materials, as approved by the District Engineer, excavated from the required excavations and approved borrow areas shown on the drawings.

4-03. Materials. - a. General. - All materials from required excavations shall be used in the embankment, if, as excavation proceeds, they are found suitable by the District Engineer. Brush, roots, sod, any type of organic materials, and other perishable or unsuitable material as determined by the District Engineer shall not be placed in the embankment. Materials shall not be wasted except by specific instructions from the District Engineer.

b. Borrow. - Other suitable materials shall be borrowed from locations shown on the drawings in accordance with Paragraph 3-05. The origin of any material from either structure or borrow excavation does not definitely determine where it will be used in the embankment. Materials from two or more sources may be required to be used at the same time and in the same part of the embankment, mixing being done in the process of placing by systematic dumping, spreading and bulldozing. Materials from one area may be required to be used in different parts of the embankment.

c. Test requirements. - The various types of earth fill defined in Paragraph 4-01 shall conform to the test requirements and approved classification established by the Soils Laboratory, U. S. Engineer Office, Providence, R. I. The Area Engineer shall furnish the necessary labor and facilities for taking test samples which will be removed from the embankment by representatives of the District Engineer and subjected to field tests or boxed for shipment to the Soils Laboratory. Test samples will be taken at such intervals as will give, in the opinion of the District Engineer, a comprehensive knowledge of the material and its placement and compaction in each section of the embankment.

4-04. Scarifying. - Immediately prior to the placing of materials in the embankment, and after stripping has been completed (see Paragraph 3-03), the entire foundation of the embankment shall be thoroughly scarified (see Paragraph 4-06 d (2)).

4-05. Filling of excavations in embankment area. - a. General. - The stump holes and other excavated areas within the limits of the embankment and as otherwise shown on the drawings shall be filled with random or impervious materials in the dry as directed by the District Engineer. The fill shall be placed in layers, moistened, and rolled in accordance with Paragraph 4-06, whenever, in the opinion of the District Engineer, it is possible to do so. Material which cannot be compacted by roller equipment on account of clearances shall be spread in 4-inch layers and compacted with hand or power tampers which shall give the degree of compaction required for the embankment. As the fill is brought up, the side slopes of the cut or hole shall be scarified by equipment or by hand if necessary to provide a bond between the fill and the original ground material (see Paragraph 4-06 d (2)).

b. Stump holes. - The sides of stump holes shall be broken down with bulldozers or a disc harrow so as to flatten out the slopes, and the hole then filled with approved material and properly rolled or tamped in place.

4-06. Rolled fill. - a. General. - The impervious and random sections of the embankment shall be constructed with a crown running with the center line of the dike and with slopes approximately on a 2 percent grade toward the edges of the embankment. This slope shall be maintained until the completion of the embankment, thus bringing up together the impervious and random sections, unless otherwise directed by the District Engineer.

b. Furnishing and placing. - (1) The Area Engineer may use power shovels, draglines, or any type of excavating machinery which is capable of excavating the materials in a dry condition. The District Engineer will specify the location in the borrow areas and the depth to which excavation shall be made. The Area Engineer may use any approved method of transporting materials in natural dry condition to approved locations in the embankment. The dumping of the successive loads shall be at locations as directed or approved by the District Engineer. When two different materials are being moved into a section of the embankment, they shall be spotted and dumped systematically so that in any area of the section there are approximately the required proportions of the material. After dumping, the materials for the impervious section shall be bulldozed or otherwise spread in approximately 8-inch layers and rolled (see Paragraph 4-06 d). The random material shall be spread in approximately 12-inch layers and rolled (see Paragraph 4-06 d). Should the material for the various sections of the embankment be too high in water content when dumped, it shall be bulldozed or otherwise spread and harrowed or stirred and left for a sufficient time to allow the surplus water to dry out before being rolled. If, in the opinion of the District Engineer, the rolled surface of any layer of the materials is too smooth to bond properly with the succeeding layer, or if the materials have dried out sufficiently to cause cracks in the surface, it shall be roughened or loosened by a disc harrow, or other approved means, and dampened, if required, before the succeeding layer is placed thereon. All roots, trash, and debris shall be

removed promptly from the embankment and disposed of to the satisfaction of the District Engineer. Stones greater than 6 inches in diameter shall be removed from the impervious and random sections and disposed of as directed by the District Engineer. The entire surface of the embankment shall be maintained in such condition that construction equipment can travel thereon. Routing of construction equipment on the embankment shall be subject to direction by the District Engineer.

(2) Any embankment material lost or loosened, after being placed in the embankment and before the completion and acceptance of the completed work, because of any operation of the Area Engineer or any causes that, in the opinion of the District Engineer, were avoidable or under the control of the Area Engineer, shall be replaced to the satisfaction of the District Engineer and without additional credit. (See Paragraph 4-13 c).

(3) The Area Engineer shall cease work on the embankment at any time when satisfactory work cannot be done on account of rain, high water, cold weather, or other unsatisfactory conditions.

c. Moisture control. - To obtain the desired compaction for the varying kinds of materials used, the moisture content of the material being placed shall be the optimum required for satisfactory compaction as determined by the District Engineer. If required, the compacted surface shall be sprinkled as directed immediately before placing each new layer. The moisture content shall be sufficient to dampen the filled materials as required, but the amount of sprinkling shall be controlled so that no free water will appear on the surface during or subsequent to the rolling. An adequate supply of water shall be available. Jets shall not be directed at the embankment material with such force that the finer materials are washed out.

d. Compaction. - (1) Tamper type roller. - Rolling for the impervious section of the embankment shall be done by a tamper type twin roller such as a "sheeps-foot" roller, water or sand ballasted, having tamping feet uniformly staggered over its cylindrical surface, and equipped with cleaners; or other satisfactory type of tamper roller as approved by the District Engineer. Each tamping foot shall project approximately 7 inches from the roller's cylindrical surface and shall have a face area of not less than 5 and not more than 7 square inches. The spacing shall be such as to provide a minimum of two tamping feet for each square foot of cylindrical surface. Addition or reduction in the number of tamping feet shall be made when directed by the District Engineer. The total weight of the roller in pounds divided by the total area of the maximum number of tamping feet in one row parallel to the axis of the roller shall be not less than 115 pounds per square inch tamping foot area with the drum empty, and not less than 200 pounds per square inch tamping foot area with the drum ballasted. The design and operation of the tamping roller shall be subject to the approval of the District Engineer.

(2) Rolling impervious section. - When the moisture content and condition of the spread impervious layers of the embankment are satisfactory to the District Engineer, the Area Engineer shall roll the impervious section of the embankment with tamper type twin rollers. Each set of rollers shall be pulled by a crawler type tractor of suitable power, weighing not less than 20,000 pounds, manufacturer's standard weight, at a speed of approximately 2-1/2 miles per hour. Each square foot of each layer of the embankment material shall be compacted by not less than six passes of the rollers. Additional passes of the rollers shall be made if necessary to obtain the compaction desired by the District Engineer. Successive trips of the rollers shall overlap by at least 2 feet. Failure to comply with this requirement for careful rolling will be a cause for additional trips. Where new material abuts old material, either in place or in embankment, the old material shall be cut or broken by machine or hand methods approved by the District Engineer, until it shows the characteristic colors of undried materials, and the rollers shall work on both materials, bonding them together. Portions of the earth fill which the roller cannot reach for any reason shall be thoroughly compacted in 4-inch layers by tamping with hand or power tampers. The degree of compaction for such portions of the earth fill shall be equivalent to that obtained by sprinkling and rolling as specified for the other portions of the earth fill.

(3) Rolling random section. - Rolling of the random section of the embankment shall be the same as specified above except that a minimum of 3 passes of the rollers will be required. When conditions of the work so require, as determined by the District Engineer, rolling may be done by a crawler type tractor weighing not less than 20,000 pounds; in such cases a minimum of four passes of the tractor treads on each square foot of embankment area will be required.

(4) Tests for compaction. - Samples of all embankment materials for testing, both before and after placing and compaction, will be taken at frequent intervals by the District Engineer. Corrections, adjustments and modifications of methods, selection of materials and moisture content will be made from these tests to secure the maximum density of the materials in the embankment (see Paragraph 4-03 c).

e. Impervious fill. - Impervious fill shall be selected and secured from required excavations and borrow areas as directed by the District Engineer and shall be placed in the impervious section of the embankment throughout the entire length.

f. Random fill. - Random fill shall be secured from required excavations and borrow areas as directed by the District Engineer, and shall be placed in the random sections of the embankment. In general, this material shall be placed so the coarser portions are toward the landside edge, and the finer portions near the selected impervious section, so that a gradational transition is effected from the impervious to the random section.

4-07. Removal of objectionable material. - The Area Engineer shall excavate, remove and dispose of any material from the embankment sections, which the District Engineer considers objectionable in such locations, and refill the area as directed in accordance with Paragraph 4-05.

4-08. Slides. - In case of slides in any part of the embankment during the construction or after completion, but prior to the final acceptance of the work, the Area Engineer shall cut out and remove the area specified by the District Engineer and then rebuild the excavated area in accordance with these specifications.

4-09. Frozen materials. - No earth shall be placed upon a frozen surface, nor shall frozen earth, snow or ice be placed in the embankment. In cases of emergency, the District Engineer may require frozen material to be stockpiled for later use in the embankment.

4-10. Shrinkage or settlement. - No measurement will be made of additional material placed on account of settlement of the foundation or shrinkage during construction. The cost of placing and compacting such additional material shall be included in the various items of the fill. Measurement and credit of all required fill material excavated and transported to point of placement will be in accordance with Section III.

4-11. Temporary drains and ditches. - The Area Engineer shall maintain the site of the work and the grounds immediately adjacent thereto free from collected surface water, if, in the opinion of the District Engineer, such collected water affects the safety or condition of the work. Such temporary drains and ditches shall be constructed as are deemed necessary and directed by the District Engineer.

4-12. Topsoil and sodding. - a. Placing topsoil. - Unless otherwise authorized by the District Engineer, a suitable topsoil shall be placed on the slopes and top of the earth dike as shown on the drawings. Credit for furnishing and placing topsoil will be made under Item 14 (see Paragraph 8-01 e(1).

b. The area upon which topsoil has been placed shall be sodded or seeded as specified in Paragraph 8-01. Measurement and credit will be made as specified in Paragraph 8-01 e(2).

4-13. Measurement and credit. - a. The quantities to be credited under Items 6 and 7 will be the number of cubic yards placed as directed, measured in place after compacting. Credit shall include the work of preparing the base, spreading in layers, wetting, rolling or tamping, trimming to line, and shall include all labor and materials incidental to completing the embankment, not specifically included under other items. Credit will be made under Items 6 and 7 as applicable (see Paragraph 1-07).

b. To determine the quantities for which credit will be made, a survey will be conducted prior to the beginning of the work. The true

surface condition will be shown by cross sections and profile and the measurement of the quantities will be based upon this survey. The quantities will be the volume between the original surface at the beginning of the work and the slope lines and grades as indicated on the drawings, or as directed by the District Engineer.

c. Additional credit will be made to replace embankment washed out by flooding or scouring, or that required to be removed on account of slides, or the removal and disposal of all objectionable materials; provided such replacement of embankment was not caused by negligence or carelessness of the Area Engineer. Quantities for additional credit will be measured as directed by the District Engineer, and credit will be made under the applicable items.

SECTION V. MISCELLANEOUS BACKFILL AND DRAINS (Items 8 to 11 incl.)

5-01. General. - "Gravel bedding," Item 8, will be required for drains as shown on the drawings and for filters. "Semi-compacted backfill," Item 9, is required for backfill at the manhole structure and other structures as shown on the drawings. "V. C. Pipe," Items 10 and 11, will be required for drains and for connecting existing tile pipe to a manhole where shown on the drawings or as required by the District Engineer.

5-02. Gravel bedding. - (Item 8). - a. Work included. - The Area Engineer shall place a layer of gravel or crushed stone of the specified quality required for drains at the locations shown on the drawings or as directed by the District Engineer.

b. Materials. - (1) Gravel bedding shall consist of suitable coarse clean gravel satisfactorily graded within the specified limits and unless otherwise directed, not more than ten percent by weight shall pass a sieve having 10 meshes to the inch, and all shall pass a 2-inch square mesh screen. The material shall be obtained from sources approved by the District Engineer, be screened, and placed directly in position.

(2) Crushed stone shall consist of angular fragments of uniform quality throughout, free from soft or disintegrated stone, dirt or other objectionable matter. The stone shall be uniformly graded within the specified limits. Unless otherwise directed, not more than 10 percent by weight shall pass a No. 4 sieve, and all shall pass a 2-inch square mesh screen. The material shall be obtained from sources approved by the District Engineer, be screened, and placed directly in position.

c. Placing. - The material shall be placed as shown on the drawings or as directed, and with such hand-placing as may be necessary to trim to the required slopes. The Area Engineer will not be required to tamp or roll the material, but shall consolidate it with water to the extent directed so that no settlement will later result.

d. Measurement and credit. - The quantity to be credited under Item 8 will be the number of cubic yards of gravel or crushed stone furnished and placed to the limits shown on the drawings, or ordered. Credit will be made under Item 8, "Gravel Bedding."

5-03. Semi-compacted backfill (Item 9). - a. Work Included. - The Area Engineer shall place, grade, and consolidate materials required for backfill of the concrete structures, and elsewhere as directed.

b. Materials. - Materials shall be obtained from stockpiles of excavated materials (see Paragraph 3-01 b), or may be obtained directly from required excavations. Backfill material shall be free from stumps, roots, sod, rubbish, or other unsuitable materials or substances.

c. Placing. - The backfills shall consist of materials suitable for the purpose as determined by the District Engineer, and shall be placed in successive layers of not more than 12 inches in depth for the full width of the cross section. Each layer shall be consolidated with water or otherwise compacted to the extent directed so that no settlement or voids will later result. The backfill adjacent to concrete structures shall be thoroughly compacted in 4-inch layers by tamping with hand or power tampers unless otherwise directed by the District Engineer.

d. Measurement and credit. - Measurement will be made by the cubic yard for the amount of semi-compacted backfill placed in the completed work to the lines and grades shown on the drawings or as directed by the District Engineer. Quantities will be measured in place after any settlement. Credit for all work in connection with furnishing and placing semi-compacted backfill will be made under Item 9, "Semi-compacted backfill".

5-04. V. C. pipe (Items 10 and 11). - a. Work included. - The Area Engineer shall furnish and lay tile pipes, including specials of the required diameters for drains and for connecting existing tile pipe to the manhole, as shown on the drawings.

b. Materials. - (1) All pipes shall be bell-and-spigot, vitrified clay pipe, conforming to the requirements of Federal Specification SS-P-361, or subsequent amendments or revisions thereof. Each pipe shall be carefully inspected immediately before laying and no cracked, broken or otherwise imperfect pipe shall be used, except for minor defects which, in the opinion of the District Engineer, do not impair the fitness of the pipe for the purpose intended.

(2) Subject to the approval of the District Engineer, non-reinforced concrete pipe conforming to the provisions of the A.S.T.M. C14-35 standard specifications for concrete sewer pipe may be substituted for tile pipe. The provisions of subparagraph (1) above, specifying inspection and selection of pipe, shall apply.

c. Excavation. - Excavation shall be done as shown on the drawings and as provided for in Paragraph 3-04. Pipe trenches shall have a depth of not less than 2 feet with vertical sides and a width 2 feet greater than the outside diameter of the pipe, unless otherwise directed. The bottom of the trench throughout its length shall be carefully formed to fit the circular shape of the pipe, so that the pipe shall be firmly supported on the bottom and for at least 3 inches up each side. Where encountered, rock or boulders shall be removed to a depth sufficient to clear the underside of the pipe and the voids backfilled with well compacted suitable material.

d. Laying pipe. - (1) Mortar joints. - All pipe shall be placed in the trench immediately after the excavation is completed. Proper care shall be used in handling the pipe to avoid injury or breakage. The pipe shall be carefully bedded, and properly connected and jointed. Bell holes shall be bedded to insure that each pipe shall rest firmly upon its

bed for the entire pipe length. The pipe shall be laid true to the lines and grades shown on the drawings or as staked in the field, with bells upgrade and with spigot ends fully entered in the bells. Joints shall be made with cement mortar composed of one part Portland cement and 2-1/2 parts sand. All mortar used shall be thoroughly mixed either by hand or in a mechanical batch mixer. Mortar shall be prepared in such quantities that it can be used entirely before it has attained its initial set. The minimum amount of water sufficient to make a workable mortar shall be used. Cement and sand used in mortar shall meet the requirements of Paragraph 6-02. The spigots shall be centered in the bells, and there shall be no shoulders or unevenness of any kind along the invert of the pipes. Special care shall be taken that the joint space be of equal width around the pipe, making use of jute or oakum gaskets soaked in cement grout to center the pipe. The mortar shall be thoroughly troweled into the joint, and a sufficient overfill shall be made to hold the mortar in the joint firmly in place. Concrete joints shall be immediately coated with at least one inch of moist earth over the top third of the pipe. The interior of the pipe shall be carefully cleaned after laying to remove dirt, mortar and other obstructions.

(2) Open joints. - Open joint pipe shall be laid in gravel or crushed stone in accordance with the provisions of Paragraph 5-04 d (1), except for joints. Pipes laid with open joints shall be true to the lines and grades shown on the drawings or as staked in the field, with bells upgrade and with spigot ends fully entered into the bells. Every third length of pipe shall be perforated. The spacing and dimensions of holes for perforated pipe shall be manufacturers' standard. A strip of burlap at least 6 inches in width and 36 inches in length shall be carefully and securely wrapped around the pipe joints.

e. Backfilling. - (1) Pipe with mortar joints. - Backfill material shall be evenly spread and compacted under and around the pipe. Backfill over the pipe shall be done in accordance with the provisions of Paragraph 5-03, unless otherwise shown on the drawings or directed by the District Engineer.

(2) Pipe with open joints. - Backfill material for the open joint pipe shall be suitably graded gravel or crushed stone having a maximum size of 2 inches, and conforming to the requirements of Paragraph 5-02. The gravel or crushed stone shall be placed around and over the pipe to the limits shown on the drawings or as directed.

f. Measurement and credit. - (1) Measurement for credit will be based on the linear feet of pipe of the size installed. Credit will be made under Items 10 and 11 as applicable (see Paragraph 1-07), which shall include all costs of furnishing and installing the pipe, except the cost of excavation and backfilling.

(2) Credit for excavation will be made under Item 3 (see Paragraph 3-04). Credit for earth backfill will be made under Item 9 (see Paragraph 5-03 d). Credit for gravel or crushed stone backfill will be made under Item 8 (Paragraph 5-02 d).

SECTION VI. CONCRETE IN MANHOLE BASE (Item 12)

6-01. Work included. - The Area Engineer shall furnish and place Class "B" concrete, containing 2-inch maximum size aggregate, required for the base of the brick manhole as shown on the drawings and in accordance with these specifications or modifications designated by the District Engineer.

6-02. Concrete. - a. Composition and strength. - Concrete shall be composed of cement, fine aggregate, coarse aggregate and water so proportioned and mixed as to produce a plastic, workable mixture suitable to the specific conditions of placement. The mixes will be designed to secure concrete having an average compressive strength of at least 3,000 pounds per square inch at the age of 28 days, as determined by breaking standard 6-inch diameter by 12-inch height or 8-inch diameter by 16-inch height test specimens. Test specimens will be taken by the Government inspector as directed by the District Engineer.

b. Materials. - All materials shall be obtained from sources approved by the District Engineer in advance of their use in the work.

c. Proportioning. - All concrete materials will be proportioned so as to produce a workable mixture. The exact proportions of all materials entering into the concrete shall be as directed by the District Engineer. The Area Engineer shall provide all equipment necessary to positively determine and control the actual amounts of all materials entering into the concrete. Each cubic yard of concrete shall contain not less than 4.0 bags or 376 pounds of cement. The total water content for a bag of cement for each batch of concrete shall not exceed 6.5 gallons or 54.1 pounds.

d. Mixing and placing. - The Area Engineer may provide at the site of the work an approved power driven mixer in good condition of adequate size for the work, or the District Engineer may approve the use of truck mixed concrete from a commercial source. The minimum time for mixing each batch, after all materials are in the mixer, shall be 1-1/4 minutes. Concrete shall be conveyed from mixer to forms as rapidly as practicable, by methods which will prevent segregation or loss of ingredients, and shall be deposited as nearly as practicable in its final position. All concrete shall be placed in the dry before initial set has occurred, upon surfaces prepared as directed by the District Engineer. All top surfaces not covered by forms and which are not to be covered by additional concrete or backfill shall be carried slightly above grade and struck off by board screed.

e. Finishing and curing. - Immediately after placement, the concrete shall be properly forked back along the faces of all forms by the use of standard concrete forks or spades unless otherwise specifically authorized or directed by the District Engineer. The finished surfaces

shall be free from sand streaks or other voids and the plastering over of such surfaces will not be permitted. Defective concrete shall be repaired as directed by the District Engineer. All concrete shall be adequately protected and cured as directed by the District Engineer.

6-03. Forms. - The type, size, shape, quality and strength of all materials of which the forms are made shall be subject to the approval of the District Engineer. Forms shall be built true to line and grade, and shall be mortar-tight and sufficiently rigid to prevent displacement or sagging between supports. Their surfaces shall be smooth and free from irregularities, dents, sags, or holes when used for permanently exposed faces. Bolts and rods used for internal ties shall be so arranged that, when the forms are removed, all metal will be not less than 2 inches from any concrete surface. Forms shall be thoroughly wetted immediately before the placing of concrete. Forms shall be removed as directed by the District Engineer, and all removal shall be accomplished in such manner as will prevent injury to the concrete.

6-04. Embedded items. - The Area Engineer shall build into, or set, or attach to the concrete, miscellaneous metal objects as shown on the drawings or required by the District Engineer. All necessary precautions shall be taken to prevent these objects from being displaced, broken or deformed.

6-05. Measurement and credit. - Credit will be made under Item 12, "Concrete" for the volume of concrete satisfactorily placed to the lines and grades shown on the drawings or directed by the District Engineer, and shall include all cost for materials, equipment, labor and incidental expense connected with placing the concrete, and doing all work described in Paragraph 6-01 to 6-04, inclusive.

SECTION VII. MISCELLANEOUS IRON AND STEEL (Item 13)

7-01. General. - All metals, unless otherwise specified, shall conform to applicable Federal Specifications, and, when not covered thereby, to applicable A.S.T.M. specifications. All castings shall have the pattern or mark number cast on them. Unless otherwise authorized by the District Engineer, the scale weights of each casting or forging after machining shall be within 5 percent of the weights as calculated from the dimensions specified or shown on the drawings. Castings shall conform, at the minimum section thereof, to the following dimensional tolerances: where embedded in concrete, to within 1/8 inch; where not embedded in concrete, to within 1/16 inch of the dimensions shown on the drawings.

7-02. Materials and workmanship. - Manhole frames, covers and steps and adjustable sewer inlet as shown on the drawings shall be furnished and installed. All metal required in the work shall meet the requirements for iron castings, gray: - Federal Specification QQ-I-652, class as indicated. Tensile tests and chemical analysis will not be required.

7-03. Measurement and credit. - a. The quantity to be credited under Item 13, "Miscellaneous Iron and Steel," will be the number of pounds respectively furnished and installed in accordance with the drawings and specifications. Wherever practicable, the quantities shall be determined by weighing the articles and materials. When weighing is not practicable, the actual weight of each part or item involved will be determined by the District Engineer, who will use for that purpose manufacturer's weights, catalog weights, and computed weights. The weight of all tare, packing, and blocking will be deducted, using only net weights for credit quantities; provided, that no credit will be made for any weight in excess of 5 percent more than the computed weight as determined from the drawings.

b. In calculating computed weights the following unit weight will be used unless otherwise specified:

Cast Iron - 0.2604 pounds per cubic inch.

SECTION VIII. MISCELLANEOUS (Items 14 to 16 incl.)

8-01. Placing topsoil and sodding embankment slope (Items 14 and 15). a. Work included. - (1) The Area Engineer shall furnish and place topsoil on the slopes of the earth dike as shown on the drawings, and on other areas as required by the District Engineer. Under Item 14, acceptable topsoil shall be placed to the required depth over the required areas. Under Item 15, the prepared topsoil surface shall be sodded and seeded when and as directed by the District Engineer.

(2) Unless otherwise directed by the District Engineer, sodding and seeding shall be completed by September 15th of the current construction season, and any portion of the sodding and seeding operations not so completed shall be deferred until the following spring season. The Area Engineer shall be responsible for proper maintenance of the embankment slopes and repairs made necessary by erosion until the entire work is completed and accepted.

b. Placing topsoil. - After the earth dike has been completed to the required height and dimensions, the Area Engineer shall apply the stored topsoil (see Paragraph 3-01 b) or additional acceptable topsoil, if necessary, to the specified depth when compacted, over the slopes of the embankment to the limits shown on the drawings. The topsoil shall be lightly rolled or tamped and any unevenness of surface shall be corrected to conform to finished grades.

c. Sodding. - (1) The slopes of the earth dike shall be planted by spot sodding with living sods of Bermuda or some other acceptable grass which will best meet the climatic conditions as approved by the District Engineer. Each sod shall have an area of not less than 16 square inches. Sods shall be placed not more than 18 inches center to center for the minimum-sized sods; larger sods may be spaced slightly farther apart as directed. Sods shall be covered with one-half to one inch of earth, in such manner as to protect the roots from drying out. Sods shall be placed as soon as practicable after cutting, and newly placed sods shall be kept moistened by sprinkling when and as required by the District Engineer for the entire period of the work.

(2) Except as otherwise specified in subparagraph a (2) above, sodding shall be commenced immediately upon completion of the dike to final grade and cross section and shall be prosecuted at a rate satisfactory to the District Engineer. Seeding shall be done to supplement the sodding operations.

d. Seeding. - (1) Preparation. - All grass or cover crop seed shall be sown when directed by the District Engineer so as to secure the greatest possible protection against erosion. The finished surface grade of the slopes shall be maintained in a true and even condition during the seed-sowing operation, and the Area Engineer shall rake the soil to a

depth of three-quarters of an inch (3/4") by using iron rakes immediately previous to sowing seed. All raking shall be done in a direction parallel to the contour lines on the slope and not uphill or downhill. All sticks, stones, weeds or trash appearing on the surface shall be removed.

(2) Seed mixture. - The following mixture will be approved for each acre of seeding:

Perennial Rye Grass	7 lbs.
Orchard Grass	15 lbs.
Hard Fescue	4 lbs.
Kentucky Blue	6 lbs.
Sheep Fescue	6 lbs.
Timothy	7 lbs.
Perennial Red Clover	4 lbs.
White Clover	4 lbs.
Red Top	7 lbs.
Total per acre	60 lbs.

for all seeded areas, about 15 pounds of oats per acre shall be added if the planting is done between the middle of June and the middle of September.

(3) Method of seeding. - The Area Engineer shall take advantage of favorable weather and shall employ a method of sowing satisfactory to the District Engineer. The seed shall be raked in and the whole surface then lightly rolled. Seeding shall be done immediately after the preparation of the earth surface unless otherwise directed. If there be any delay, and if weeds grow in and with the grass, such weeds shall be cut before they go to seed or at such time as directed by the District Engineer. If any loam is washed away or any portions of the seeded areas are not covered by grass, the Area Engineer shall replace the topsoil, fertilize and re-seed.

(4) Maintenance. - The Area Engineer shall maintain the areas sown to grass seed on each section of the project, until all work on this section has been completed and accepted by the District Engineer. This maintenance shall consist of occasional mowing with a scythe or mechanical mower, watering during periods of drought, and removal of conspicuous weeds, or any other similar operations whenever required by the District Engineer. The turf areas shall be fertilized with an acceptable commercial lawn fertilizer of a quality equal to Vigoro or Scott's lawn fertilizer at the customary quantity per acre recommended by the manufacturer.

e. Measurement and credit. - (1) The quantity of topsoil to be credited under Item 14 will be the number of cubic yards actually placed in accordance with directions, measured after compacting whether obtained from stockpiles or from other sources by the Area Engineer. Credit shall include the costs of all labor, materials and expenses incidental to furnishing and placing the topsoil. Credit will be made under Item 14, "Topsoil".

(2) The quantity to be credited under Item 15 will be the number of acres sodded and seeded. Credit shall include all costs for sodding and seeding as specified in subparagraphs c and d above, and for all materials and expenses incidental thereto. Credit will be made under Item 15, "Sodding and Seeding".

8-02. Manhole brickwork. (Item 16). - a. Work included. - The Area Engineer shall construct manholes at the points indicated on the drawings, or as directed by the District Engineer.

b. Description. - (1) Manholes shall be built of brick masonry on concrete bases. They shall conform in shape, size, dimensions and in other respects to the details indicated on the drawings. Excavation for the manholes shall comply with the provisions of Paragraph 3-04, as far as they are applicable.

(2) The Area Engineer shall furnish all the materials required for the construction of the manhole, including bricks, cement, sand, hydrated lime, waterproofing compounds, concrete, cast iron manhole frames, covers and steps, steel reinforcement and all other materials required. For cast iron frames, covers and steps see Section VII. The concrete for manhole bases shall be Class "B" and shall comply with the applicable provisions of Section VI.

c. Brick masonry. - (1) Kind of brick. - The brick shall be good, sound, hard and uniformly burned brick, regular and uniform in shape and size, of compact texture and satisfactory to the District Engineer. Brick shall comply with Federal Specification SS-B-691, Grade B, standard size 2-1/4 by 3-3/4 by 8 inches. In case the District Engineer rejects any brick, the same shall be immediately removed from the work and brick satisfactory to the District Engineer substituted. Brick shall be culled and compactly piled as soon as delivered.

(2) Mortar for brickwork. - The mortar shall be composed of one part Portland cement and 2-1/2 parts sand, to which approximately 20 pounds of hydrated lime shall be added for each sack of cement. All mortar used shall be thoroughly mixed either by hand or in a mechanical batch mixer. Mortar shall be prepared in such quantities that it can be used entirely before it has attained its initial set. The minimum amount of water sufficient to make a workable mortar shall be used. Cement and sand used in mortar shall meet the requirements of Paragraph 6-02. The hydrated lime shall be of approved commercial quality suitable for the use intended.

(3) Brick laying. - The bricks shall be clean and shall be thoroughly wetted shortly before they are put into the wall and each brick shall be laid in a full bed and joint of mortar, without requiring subsequent grouting, flushing or filling, and shall be thoroughly bonded as directed. Brickwork shall be satisfactorily protected against weather and frost until the mortar has set.

(4) Plastering. - Outside faces of brick masonry shall be plastered with Portland cement mortar. The thickness of the cement mortar plaster shall be from 1/4-inch to 3/8-inch and the mortar shall be carefully spread and thoroughly troweled, leaving a smooth exterior surface.

d. Iron castings. - (1) Installation. - Cast iron steps shall be as detailed on the drawings. The manhole covers and frames shall be of the size and design shown on the drawings.

(2) Painting castings. - New castings before being shipped from the foundry shall be given one coat of coal tar pitch varnish applied in a satisfactory manner so as to make a smooth coating, tough, tenacious and not brittle or with any tendency to scale off.

e. Credit. - (1) Credit under Item 16, "Manhole Brickwork", shall include all costs for furnishing the materials, equipment, and labor required to construct the manhole brickwork complete to the lines and grades shown on the drawings, together with plastering of outside faces as described in Paragraph 8-02 c (4), except the cost of excavation and backfilling, concrete and the metal work.

(2) Credit for excavation will be made under Item 3 (see Paragraph 3-04 e). Credit for backfilling will be made under Item 9. (See Paragraph 5-03 d). Credit for concrete will be made under Item 12 (see Paragraph 6-05). Credit for manhole frames, covers and steps will be made under Item 13 (see Paragraph 7-03).

8-03. Cleaning up. - a. Work included. - The Area Engineer shall remove all construction equipment and all temporary structures built or used by him, shall remove rubbish of all kinds from the site of the work, and from any grounds which he shall have occupied within the limits of the work, and shall leave the site of the work in a clean condition satisfactory to the District Engineer. All materials salvaged shall be the property of the Government, unless otherwise designated by the District Engineer.

b. Credit. - For all work, materials and incidentals required to clean up as set forth in a above, the Area Engineer will receive no direct credit, but credit shall be considered as having been included under Items 1 to 16, inclusive.